

Claims

1. A quantum-dot LED comprising:
a substrate;
5 a n-type semiconductor layer formed on the substrate;
an insulator layer formed on the n-type semiconductor
layer and provided with a plurality of holes;
quantum dots formed by filling the holes; and
a p-type semiconductor layer formed on the insulator
10 layer in which the quantum dots are formed.
2. A quantum-dot LED comprising:
a substrate;
a n-type semiconductor layer formed on the substrate;
15 a first insulator layer formed on the n-type
semiconductor layer and provided with a plurality of holes;
quantum dots formed by filling the holes;
a barrier layer formed on the first insulator layer in
which the quantum dots are formed;
20 a second insulator layer formed on the barrier layer
and provided with holes and quantum dots like the first
insulator layer;
a p-type semiconductor layer formed on the second
insulator layer.
- 25 3. The quantum-dot LED according to claim 2, wherein
the first and second insulator layers formed interposing the
barrier layer therebetween has a multi-layer structure.
- 30 4. The quantum-dot LED according to claim 2 or 3,
wherein the barrier layer is of one selected from the group
consisting of GaN, GaAs and GaP.
- 35 5. The quantum-dot LED according to claim 1 or 2,
wherein the holes are a nano-hole.

6. The quantum-dot LED according to claim 1 or 2, wherein the holes have a size range of 1 nanometer to 100 nanometers.

5 7. The quantum-dot LED according to claim 1 or 2, wherein the quantum dots are formed from one selected from the group consisting of InGaN, InGaAs and InGaP.

8. The quantum-dot LED according to claim 1 or 2, wherein the quantum dots comprise an upper surface being in contact with the p-type semiconductor layer, and a lower surface being in contact with the n-type semiconductor layer.

9. The quantum-dot LED according to claim 1 or 2, wherein the size and/or density of the holes are/is determined by deposition time of the insulator layer.

10. A method for fabricating a quantum-dot LED, the method comprising the steps of:

20 forming a n-type semiconductor layer on a substrate;
depositing a first insulator layer having first holes on the n-type semiconductor layer;
filling the first holes of the first insulator layer to form first quantum dots; and
25 depositing a p-type semiconductor layer on the first insulator layer in which the quantum dots are formed.

11. The method according to claim 10, further comprising the steps of:

30 (a) after the step of forming the quantum dots, forming a barrier layer on the insulator layer in which the quantum dots are formed;
(b) forming a second insulator layer having second holes on the barrier layer; and
35 (c) filling the second hole of the second insulator layer to form second quantum dots,

wherein the steps (a), (b) and (c) are repeated at least once.

- 5 12. The method according to claim 10 or 11, wherein in the step of depositing the insulator layers, the size and/or density are/is determined by deposition time of the insulator layer.